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Economic and Social Determinants of Infant Under-Five Years' Mortality in Cameroon

Zakariaou Njoumemi[1, 3, 4, *], Altiné Fadimatou[2, 3], Samuel Honore Ntavoua[3, 6], Iliassou Nkariepoun Njoya[4, 5], Ousseni Mongbet[3], Rahimatou Manouore[3, 5]

[1]Department of Public Health, Faculty of Medicine and Biomedical Sciences, University of Yaounde I, Yaounde, Cameroon

[2]Department of Public Health, Faculty of Medicine and Biomedical Sciences, University of Garoua, Garoua, Cameron

[3]Policy and Programme Analysis Division, Health Economics and Policy Research and Evaluation for Development Results Group (HEREG), Yaounde, Cameroon

[4]Economic and Social Division, Strategic Purchasing for System Performance, Monitoring and Evaluation Consulting Group, Yaounde, Cameroon

[5]Africa Innovation Technologies and Services, Yaounde, Cameroon

[6]Faculty of Economics and Management, University of Yaounde II, Soa-Yaounde, Cameroon

Email address:

njoumemiz@gmail.com (Zakariaou Njoumemi)

[*]Corresponding author

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Abstract: Infant mortality remains a major international public health problem. The situation in sub-Saharan Africa is particularly worrying, as children are at high risk of dying before their fifth birthday. This study analyses the economic and social determinants of infant mortality in Cameroon using a cross-sectional study design. A nationwide stratified, two-stage sampling was used to sample 9,733 children and their respective mothers. A logistic regression model was used for both bivariate and multivariate analysis with a statistically significant level of $p<0.05$. The children were predominantly male, with a sex ratio of 1.03. Infant mortality was associated with a statistically significant difference ($p<0.05$) in economic and social characteristics of the child and its mother, such as: age of the child between 25 and 60 months, second or higher birth order, average birth weight of the child, number of 2 to 3 children in the household, age of the mother, domestic violence against the mother, non-use of contraception by the mother, mothers of children residing in the North, Far-North, East and North West regions of the country. On the other hand, infant mortality was associated with a statistically non-significant difference ($p>0.05$) in economic and social characteristics, namely: child sex, age between 13 and 24 months, low and high child weights at birth, mother's level of education, marital status, mother's employment, religion, level of economic well-being, access to media, use of modern contraception, prenatal consultations in a health center, residence in an urban area, mothers resident in other regions of the country. The elimination of preventable deaths among children under 5 five years old by 2030 will depend on the extent to which economic and social determinants are taken into account in the public policies of resource-limited countries like Cameroon.

Keywords: Economic, Social, Determinants, Mortality, Children Under Five, Cameroon

1. Introduction

Infant mortality remains a major international public health problem. The infant mortality rate (IMR) is a standardized measure of the number of deaths of children under one year of age per thousand live births [1]. While worldwide, the IMR seems to have fallen significantly in recent years, the situation in sub-Saharan Africa is still very worrying, and yet reducing the IMR is an important step

towards achieving the United Nations' Sustainable Development Goal 3 [2]. In 2021, the global under-five mortality rate was 38 per 1,000 live births, while in sub-Saharan Africa the rate was 74 deaths per 1,000 live births, compared with 67 deaths per 1,000 live births among children under five in low-income countries [3]. Children under the age of 5 have the highest probability of dying in sub-Saharan Africa. As a result, the infant mortality rate (IMR) is seen as a major public health indicator and a reflection of a country's economic and social development, as it is closely linked to maternal health and is a key determinant of a nation's health [4]. For low-income countries with limited resources, infant mortality remains a relevant and easily measurable indicator for understanding population health and the performance of a country's healthcare system [1, 5].

Worldwide in 2021, around five million children died before their fifth birthday and around 1.9 million babies were stillborn in the same year, and if rapid action is not taken to improve health services and economic and social conditions, almost 59 million children and young people will die before 2030, while almost 16 million babies will be lost to stillbirth [3]. The death of children under the age of five worldwide is one of the most critical public health issues, and improving child survival remains an urgent concern [6-8]. However, child mortality risks significantly determine life expectancy, which is one of the components of the Human Development Index [HDI] [9]. As a result, under-five mortality remains alarmingly high in many low- and middle-income countries (LMICs) [9-11]. As a result, children continue to have very different chances of survival depending on where they are born. In 2018 alone, an estimated 5.3 million children under the age of five died worldwide, with sub-Saharan Africa (SSA) contributing more than half of the death burden (2.7 million) [12-14]. Sub-Saharan Africa, which accounts for only 29% of the world's live births, recorded 56% of all under-five deaths in 2021, and South Asia 26% of the total, so these two regions bear the heaviest burden of child mortality [1, 2]. With an average of 78 under-five deaths per 1,000 live births, one child in 13 dies before his or her fifth birthday in the sub-Saharan African region, and children born in sub-Saharan Africa are subject to the highest risk of child death in the world - 15 times higher than the risk for children in Europe and North America [2, 3, 15].

In Cameroon, the current trends in infant mortality in 2022 remains a critical public health problems across the whole country [16]. The level of infant mortality varies from simple to double, from a minimum of 58 ‰ in the North-West to a maximum of 111 ‰ in the East, while as regards to juvenile mortality, its level varies even more, from 43 ‰ in the North-West to 111 ‰ in the North [17]. This is why reducing mortality and improving population health are at the heart of the 2016 -2027 Health Sector Strategy through the "Case management" strategic axis, the aim of which is to reduce overall mortality and lethality in health facilities and in the community [18]. This objective of the sector strategy is fully in line with target 3.2 of the MDGs, which stipulate that: "by 2030, eliminate preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to no more than 12 per 1,000 live births and under-5 mortality to no more than 25 per 1,000 live births" [2, 13].

In low- and middle-income countries, the economic and social conditions of development are relevant for assessing child mortality indicators, particularly for understanding the performance of the health system and the effectiveness of its maternal and child health policies [9, 19]. In Sub-Saharan Africa, most deaths among children under the age of five can be avoided if the economic and social factors of children and their families, and especially of women, are taken into account for access to quality care during pregnancy, and during and after childbirth [20]. However, in many African countries, very little is known about the relative importance of the factors affecting infant mortality. This relative lack of data makes it particularly difficult not only to describe infant mortality trends accurately, but also to understand the role of economic and social characteristics in influencing infant mortality in the general population. Meanwhile, in Cameroon, despite a general improvement in child health indicators, notably the prevalence of malaria, anemia and ARI in children, child immunization indicators and reproductive health indicators [21], no data are available on the economic and social factors affecting infant mortality. This paucity of data justifies the need to conduct a study that contributes to a good understanding of the factors determining infant mortality. Cameroon offers an opportunity to study the factors affecting infant mortality, since its prevalence is among the highest in the African region [16, 21], and the country offers a chance to explore the possible ways in which economic and social factors affect infant mortality trends. With this in mind, the aim of this study is to analyze the economic and social determinants of under-five mortality in Cameroon.

2. Methods

2.1. Study Design

This study uses a cross sectional design with retrospective population-level secondary data based on the fifth Cameroon Demographic and Health Survey (DHS-V) [22] to analyze the economic and social determinants of infant mortality in Cameroon.

2.2. Study Site and Period

The site of this study was the households across all 10 regions of Cameroon. In addition to the 10 regions, the main economic city "Douala" and Cameroon's capital city of "Yaounde" were included as separated sites in order to better capture the complex economic and social characteristics of the country's most populous cities. The data collection was conducted for the period of 16th June 2018 to 19th January 2019 during which the DHS-V was implemented by the national institute of Statistics in partnership with the Ministry

of public health.

2.3. Sampling Technique

The study used a stratified nationwide, two-stage sampling technique. In the first stage, 470 clusters were systematically selected based on the proportion of their household size. In the second stage, 28 households were selected per cluster with equal probability. In each selected household, all women aged 15-49 years with children under five were eligible to participate in the study.

2.3.1. Selection Criteria

In this sampling technique, all eligible women aged 15-49 years having children under five who voluntarily give and sign their informed consent forms were included in the study. Conversely, any woman aged 15-49 years having children under five who refused to voluntarily give and sign his/her informed consent, was excluded from the study.

2.3.2. Sample Size

In line with both the inclusion and exclusion criteria, the study involved a total sample of 9,733 children under the age of five and their respective mothers of 15 to 49 years.

2.4. Data Collection

The DHS-V survey, which focused mainly on maternal and child health issues, collected information on the mortality of children under the age of five. Infant mortality data were gathered from information obtained in the birth history section of the "Women's Questionnaire". In section 2 of the questionnaire, eligible women declared all the births they have had. Then, for each child, the date of birth, survival status, current age or age at death were collected [22].

Respondents were classified as women who had lost an under-five child and women who did not lost any under-five child in the last five years. The data were managed by identifying, sorting, and extracting relevant variables indicating the response on infant mortality in line with the economic and social characteristics of the respondents.

2.5. Statistical Analysis

The data analysis adopted a logistic regression model where the dependent variable is a binary indicator "infant mortality" which indicates whether or not the mother has lost a child in the five years preceding the survey, and the independent variables are a set of indicators with 2 or more modalities. The model thus constructs a binary logistic model to estimate the probability of a binary response as a function of a set of predictor variables. The set of independent variables includes the economic and social and demographic characteristics of the mother and child. Our dependent variable "infant mortality" is defined as follows:

$$y_i = \begin{cases} 1 \text{ if the woman has lost a under five child in the last five years} \\ 0 \text{ if the woman has not lost any under five children} \end{cases}$$

Let y_i^* the unobserved variable defined by $y_i^* = x_i\beta + \varepsilon_i$ où ε_i is a random variable with mean zero and standard deviation σ_ε, with $\frac{\varepsilon_i}{\sigma_\varepsilon}$ which follows a logistic distribution function $\phi(x) = \frac{\exp(x)}{1+\exp(x)}$.

The multivariate logistic regression model inspired by Nugroho and Widyaningsih (2016) and Asif et al. 2022 [9, 23] was used to assess the relationship between infant mortality according to a set of economic and social and demographic indicators that may influence the death of children under five.

Considering the latent variable y_i^* as follows:

$$\begin{cases} y_i = 1 \text{ if } y_i^* > 0 \\ y_i = 0 \text{ if } y_i^* \leq 0 \end{cases}$$

The model to be estimated can be written as follows:

$$y_i^* = \beta_0 + \beta\, x_i + \varepsilon_i$$

With the following detailed specifications:

$$y_i^* = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \beta_7 x_{7i} + \beta_8 x_{8i} + \beta_9 x_{9i} + \beta_{10} x_{10i} + \beta_{11} x_{11i} + \beta_{12} x_{12i} + \beta_{13} x_{13i} + \beta_{14} x_{14i} + \beta_{15} x_{15i} + \beta_{16} x_{16i} + \varepsilon_i$$

Where:

β is a vector of coefficients for the model to be estimated,

β_0 is the constant term and ε_i is the error term.

Therefore,

β_0, β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8, β_9, β_{10}, β_{11}, β_{12}, β_{13}, β_{14}, β_{15}, β_{16} are coefficients of the model to be estimated and ε_i is the error term.

x_i is a set of economic and social factors that can influence infant mortality:

x_{1i} : Age of the child (in months) i;
x_{2i} : Sex of the child i;
x_{3i} : Birth order of the child i;
x_{4i} : Weight of the child at birth i;
x_{5i} : Number of children under five in the household i;
x_{6i} : Mother's age at child birth i;
x_{7i} : Education level of the mother of child i;
x_{8i} : Marital status of the mother of child i;
x_{8i} : Employment status of the mother of child i;
x_{9i} : Religion of the mother of child i;
x_{10i} : Economic welfare status of the mother of child i;
x_{11i} : Accessibility to media by the mother of child i;
x_{12i} : Domestic violence on mother of the child i;
x_{13i} : Contraceptive use by the mother of child i;
x_{14i} : Antenatal care attendance by the mother of child i;
x_{15i} : Region of residence the mother of child i;
x_{16i} : Residence area of the mother of child i.

Data analysis was performed in Excel and Stata software

(version 14). Odds ratios were calculated. The data of this study was initially analysed on the basis of descriptive statistics and the Chi2 dependence test. This technique provided an initial view of the level of association between infant mortality and the economic and social determinants. The data analysis used two techniques: descriptive analysis (bivariate and multivariate) and multivariate explanatory analysis. Different associations were made and the results were considered statistically significant at a 95% confidence level with $p<0.05$.

2.6. Ethical Approval

Ethical approval was obtained from the ethical review committee for the protection of human subjects and adult women having children under five years participants provided written consent for themselves prior to enrolment in the study.

3. Results

3.1. Economic and Social Characteristics of Infant Mortality

The study involved a total sample of 9733 children under the age of five and their respective mothers, ranging in age from 15 to 49. The children were predominantly (50.7%) male versus 49.3% female, with a sex ratio of 1.03; but infant mortality was significantly different between the two sexes, with 10.06% of deaths among boys and 7.25% of deaths among girls ($p<0.00$). The economic and social and demographic characteristics of the children and their mothers are presented in a bivariate analysis of under-5 mortality (Table 1). In terms of child characteristics, the majority (21.38%) were under 12 months of age, followed by children aged 13 to 24 months (20.08%), 37 to 48 months (19.83%), 49 to 60 months (19.43%) and 25 to 36 months (19.30). There was a statistically significant difference in mortality, ranging from 2.58% to 2.99% between the different age groups of children ($p<0.01$). The majority of children (53.01%) were of average birth weight, of whom 44.23% survived, compared with 8.77% who died. Mortality was high (8.77%) in children of average birth weight, with a statistically significant difference in mortality ranging from 1.23% to 8.77% between the different birth weights of the children ($p<0.00$). The majority of children in the sample are from the 5th or higher birth (27.84%) and first birth (23.46%), whose death rates are 10.1% and 1.07% respectively, with a statistically significant difference between the different birth orders ($p<0.00$). The largest proportion of households in the sample had two dependent children (34.06%), followed by households with one dependent child (30.13%), whose death rates were 5.41% and 5.62% respectively, with a statistically significant difference between households ($p<0.00$).

With regard to the characteristics of the mothers, we note that the majority (49.02%) were in the 25-34 age bracket, followed by the 15-24 age bracket (31.84%) and finally the 35-49 age bracket (19.14%), whose death rates are significantly different, at 8.34%, 2.97% and 6.0% respectively ($p<0.00$). The majority of mothers had secondary education (38.5%), followed by primary education (26.64%) and finally those with no education (23.08%) and higher education (5.14%), whose death rates were respectively 4.39%, 6.65%, 5.9% and 0.38%, with a statistically significant difference ($p<0.00$). The sample shows that 80.97% of mothers of children under five are married, with an infant mortality rate of 2.25%, compared with 19.03% of single mothers, with a high infant mortality rate of 15.06%, with a statistically significant difference between them ($p<0.00$). The majority of mothers (55.64%) lived in rural areas, with a death rate of 11.86%, versus 44.36% in urban areas, with a death rate of 5.46%, with a statistically significant difference in infant mortality between rural and urban areas ($p<0.00$). Most mothers (67.51%) were employed, with an infant death rate of 13.36% versus 3.96% among unemployed mothers ($p<0.00$). The majority of mothers practiced the Christian religion (70.39%), followed by Muslim mothers (26.09%), and animists, "no religion" and mothers of other religions made up 3.52% of our sample, with infant death rates of 11.37%, 5.29% and 0.65% respectively ($p<0.00$). The poorest and poor mothers made up 18.58% and 23.49% respectively, while 23.95% belonged to the medium-wealth status and 17.08% and 15.23% to the richest and richest status respectively. In these economic classes, the death rates were 4.79% and 4.95% for the poorest and poorest, respectively, and 3.89%, 2.39% and 1.28% for the middle, richest and richest, with a statistically significant difference ($p<0.00$). With regard to access to the media, 84.05% of mothers in the sample had no access to the media and recorded an infant death rate of 15.61%, compared with 15.95% of mothers who did have access and recorded an infant death rate of 1.71% ($p<0.00$). With regard to contraceptive use, 45.67% of mothers in the sample had no intention of using a contraceptive method, followed by those who did not use but intended to use later (30.25%), while 19.91% of mothers used a modern method and 4.17% a traditional method. Regarding of child deaths among mothers using contraceptive methods, there were 9.45% and 4.54% death rates among mothers who had no intention of using a contraceptive method and those who did not use but intended to use later, respectively, with a statistically significant difference in child mortality between the various forms of contraceptive use ($p<0.00$). With regard to domestic violence against children's mothers, 76.42% of mothers in the sample had suffered domestic violence and recorded a death rate of 12.48%, compared with 22.97% of mothers who had not suffered domestic violence and recorded a death rate of 4.78% ($p<0.00$). In terms of place of prenatal consultation, 89.3% of mothers had a prenatal consultation at a health center, compared with 10.7% at a traditional birth attendant's. Here we note a death rate of 15.05% and 2.26% respectively, with a statistically significant difference ($p<0.00$). A majority of mothers (18.92%) were from the central region, followed by

mothers from the coastal region (13.35%), the north (12.5%) and at the bottom of the table the south-west region with only 1.72%. Infant mortality varied between 0.17% and 3.29% across the country's ten regions, with a statistically significant difference (p<0.00).

Table 1. *Economic and social characteristics and bivariate analyses of the sample.*

Variables	Observations (n)	Frequency (%)	Children under five years		P-value
			Survival	Mortality	
Child's characteristics:					
Age (in months)					
"Less than 12 months"	1942	21,38	18,80	2,58	<0.005
"13 to 24 months"	1824	20,08	17,47	2,61	
"25 to 36 months"	1753	19,30	16,59	2,71	
"37 to 48 months"	1801	19,82	16,83	2,99	
Sex of Child					
Male	4938	50,73	40,68	10,06	<0.001
Female	4795	49,27	42,01	7,25	
Birth order					
1 birth	2283	23,46	22,39	1,07	<0.001
2 birth	1929	19,82	18,19	1,63	
3 birth	1568	16,11	13,99	2,12	
4 birth	1243	12,77	10,38	2,39	
5 and more	2710	27,84	17,74	10,10	
Child weight at birth					
Very large	1061	10,90	8,71	2,19	<0.001
Larger than average	1906	19,58	16,48	3,10	
Average	5159	53,01	44,23	8,77	
Smaller than average	908	9,33	7,73	1,60	
Very small	463	4,76	3,52	1,23	
Don't know	236	2,42	2,01	0,41	
Number of children under five in the household					
« 0 to 1 child »	2933	30,13	24,51	5,62	<0.001
« 2 children »	3315	34,06	28,64	5,41	
« 3 children »	1928	19,81	16,96	2,85	
« 4 children and more »	1557	16,00	12,57	3,43	
Mother's characteristics:					
Mother age at child's birth (years)					
15 – 24	3099	31,84	28,87	2,97	<0.001
25 – 34	4771	49,02	40,68	8,34	
35 – 49	1863	19,14	13,14	6,00	
Education level of the mother					
No education	2246	23,08	17,18	5,90	<0.001
Primary	3240	33,29	26,64	6,65	
Secondary	3747	38,50	34,11	4,39	
Higher	500	5,14	4,76	0,38	
Marital status of the mother					
Married	7881	80,97	65,91	2,25	<0.001
Not Married	1852	19,03	16,78	15,06	
Employment status of the mother					
Worked/Employed	3162	32,49	28,53	3,96	<0.001
Unemployed	6571	67,51	54,16	13,36	
Religion of the mother					
Christians	6851	70,39	59,02	11,37	<0.001
Muslim	2539	26,09	20,80	5,29	
Animist/none/other	343	3,52	2,88	0,65	
Economic welfare quintile					
Poorest	1808	18,58	13,79	4,79	<0.001
Poorer	2286	23,49	18,53	4,95	
Middle	2331	23,95	20,06	3,89	
Richer	1895	19,47	17,08	2,39	
Richest	1413	14,52	13,23	1,28	
Accessibility to media					
No	8181	84,05	68,45	15,61	<0.001
Yes	1552	15,95	14,24	1,71	
Domestic violence on mother					
Yes	7438	76,42	63,94	12,48	<0.001
No	2236	22,97	18,20	4,78	
Contraceptive use					

Variables	Observations (n)	Frequency (%)	Children under five years		P-value
			Survival	Mortality	
Modern method user	1938	19,91	17,36	2,55	<0.001
Traditional method user	406	4,17	3,40	0,77	
Non-user - intends to use later	2944	30,25	25,71	4,54	
Does not intend to use	4445	45,67	36,22	9,45	
Antenatal care attendance/provider					
Traditional birth assistance	1041	10,70	8,44	2,26	<0.001
Health center assistance	8692	89,30	74,25	15,05	
Region of the mother					
Centre	1841	18,92	16,35	2,57	<0.001
Adamaoua	734	7,54	6,20	1,35	
East	1119	11,50	10,58	0,91	
Far-north	1003	10,31	8,01	2,29	
Littoral	1299	13,35	10,24	3,10	
North	1217	12,50	9,22	3,29	
North-west	473	4,86	4,32	0,54	
West	952	9,78	8,27	1,51	
South	928	9,53	7,96	1,57	
South-west	167	1,72	1,54	0,17	
Area of residence of the mother					
Urban	4318	44,36	38,91	5,46	<0.001
Rural	5415	55,64	43,78	11,86	
All	9733	100	82,69	17,31	

Source: Authors' calculations based on EDS 2018 data, *** p<0.01, ** p<0.05, * p<0.1

3.2. Results and Interpretation of the Logistic Regression of the Infant Mortality Function

The results of the logistic regression of the infant mortality function are presented in Table 2. The estimation of the infant mortality function indicates that the model is globally significant [Prob>chi2 (0.00)] and has an explanatory power of 19.3% (adjusted R2). Child age is an important determinant of infant mortality. Compared with children under 12 months of age, children in the 37-60 months age group were around 1.4 times more likely to die with a statistically significant difference in mortality (p<0.01), while the 25-36 months age group was 1.2 times more likely to die with a statistically significant difference in mortality (p<0.05), and children aged 13-24 months were 1.1 times more likely to die with a statistically insignificant difference in mortality (p<0.32). Female children were relatively 1.02 times more likely to die than male children, but the difference was statistically non-significant (p<0.75). Birth order is an important determinant of infant mortality, as children born in the fifth birth order and above are 58.5 times more likely to die before their fifth birthday, children born in the fourth birth order are 24.5 times more likely to die, children born in the third birth order are 13.4 times more likely to die, children born in the second birth order are 5.6 times more likely to die than children born in the first birth order (primiparous), with a statistically significant difference in deaths between the different birth orders (p<0.00). Thus, infant mortality increases with the child's birth rank. In relation to birth weights and compared to children born with high birth weights, low birth weight children are 1.27 times more likely to die, children with birth weights less close to average are 0.97 times more likely to die, children with average birth weights are 0.81 times more likely to die, children with birth weights closer to average are 0.84 times more likely to die before their fifth birthday, with a statistically non-significant difference overall (p>0.05). With regard to the number of children in the household and compared to households with one child, households with two children were 0.78 times more likely to die (p<0.01), households with three children were 0.57 times more likely to die (p<0.00), those with four or more children were 0.87 times more likely to die (p<0.19).

With regard to domestic violence, children of mothers who had experienced domestic violence were 1.23 times more likely to die than those of mothers who had not experienced domestic violence, with a statistically significant difference (P<0.01). Children of single mothers were 0.96 times more likely to die than children of married mothers. In relation to the mother's age, children of mothers in the "25-34" and "35-49" age groups were respectively 0.60 and 0.64 times more likely to die than children of mothers aged 15-24, with a highly significant statistical difference (P<0.01). Children of mothers with primary and secondary education were less likely (OR=0.91 and 0.93 respectively) than children of mothers with no education; on the other hand, children of mothers with higher education were more likely (OR=1.35) to die, but with a statistically non-significant difference (p>0.05). Children of working mothers were more likely (OR=1.14) to die than children of unemployed mothers, but with no significant difference (P>0.1). Children of mothers practicing Muslim, animist, no religion and other religions were non-significantly less likely to die than children of Christian mothers of all faiths.

Children of mothers living in rural areas were more likely (OR=1.09) to die than children of mothers living in urban areas, but this was not significant. Children of mothers in the middle, rich and very rich income quintiles were less likely to die than children of mothers in the very poor income

quintiles, while those in the poor income quintiles were more likely (OR=1.053) to die, but with a statistically non-significant difference (p>0.05). Children of mothers with access to media were slightly more likely (OR=1.01) to die than children of mothers without access, but this was not significant. Children of mothers using traditional contraceptive methods were significantly more likely (OR=1.4) to die than children of mothers using modern contraceptive methods. In relation to contraceptive use, children of mothers who did not use any contraceptive method but intended to use it later (OR=1.25; p<0.05), and also those of mothers who had no intention of using it (OR=1.47; p<0.00), were more likely to die than children of mothers using modern contraception. Children of mothers who made their prenatal visits at a health center were non-significantly more likely (OR=1.13; p<0.26) to die than children of mothers who made their prenatal visits at a traditional birth attendant. In terms of region of residence, mothers from Adamaoua (OR=0.98; p>0.05), Littoral (OR=0.62; p>0.05), Northwest (OR=0.68; p>0.05), West (OR=0.96; p>0.05), South (OR=0.98; p>0.05), were significantly less likely to die than children of mothers from the center, while children from Southwest (OR=1. 36; p>05), Far North (OR=1.29; p<0.01), East (OR=1.48; p<0.01) and North (OR=1.59; p<0.01) were significantly more likely to die than children of mothers from the Central region.

Table 2. *Logit estimation of the infant mortality function.*

Variables indépendantes	**Infant mortality (1= has already lost a child under 5; 0= has not yet lost a child under 5)**		
	OR	**95% CI**	**P value**
Child's characteristics			
Age (in months)			
"less than 12 months"	Reference		
"13 to 24 months"	1,112	[0.900 – 1.373]	0.323
"25 to 36 months"	1,238	[1,003 – 1,528]	0.046
"37 to 48 months"	1,382	[1,121 – 1,703]	0.002
"49 to 60 months"	1,373	[1,111 – 1,698]	0.003
Sex of the child			
Male	Reference		
Female	1.021	[0,895 – 1,163]	0.755
Birth order			
1= 1 birth	Reference		
2= 2 birth	5,641	[3,560 – 8,939]	0.000
3= 3 birth	13,37	[8,477 – 21,08]	0.000
4= 4 birth	24,52	[15,36 – 39,14]	0.000
5=5 and more	58,50	[36,64 – 93,40]	0.000
Child weight at birth			
Very large	Reference		
Larger than average	0,836	[0,656 – 1,065]	0.148
Average	0,809	[0,653 – 1,003]	0.054
Smaller than average	0,966	[0,721 – 1,294]	0.819
Very small	1,274	[0,901 – 1,800]	0.169
Don't know	0,580	[0,342 – 0,984]	0.044
Number of children under five in the household			
0 or 1 child	Reference		
2 children	0,780	[0,654 – 0,930]	0.006
3 children	0,569	[0,463 – 0,699]	0.000
4 children and more	0,871	[0,709 – 1,069]	0.187
Mother's characteristics			
Mother age at child's birth (years)			
15 – 24 years	Reference		
25 – 34 years	0,602	[0.477 – 0,760]	0.000
35 – 49 years	0,642	[0,489 – 0,845]	0.002
Education level of the mother			
No education	Reference		
Primary	0,912	[0,749 – 1,111]	0.364
Secondary	0,931	[0,726 – 1,194]	0.577
Higher	1,349	[0,802 – 2,268]	0.259
Marital status of the mother			
Married	Reference		
Not Married	0,960	[0,777 – 1,186]	0.708
Employment status of the mother			
No	Reference		
Yes	1,140	[0,965 – 1,347]	0.122
Religion of the mother			
Christians	Reference		
Muslim	0,923	[0,768 – 1,108]	0.393
Animist/none/other	0,990	[0,707 – 1,387]	0.957

Variables indépendantes	Infant mortality (1= has already lost a child under 5; 0= has not yet lost a child under 5)		
	OR	95% CI	P value
Economic welfare quintile of the mother			
Poorest	Reference		
Poorer	1,052	[0,863 – 1,284]	0.612
Middle	0,972	[0,771 – 1,227]	0.817
Richer	0,845	[0,626 – 1,141]	0.273
Richest	0,777	[0,532 – 1,133]	0.190
Accessibility to media			
No	Reference		
Yes	1,004	[0,797 – 1,264]	0.973
Domestic violence on mother			
No	Reference		
Yes	1,233	[1,060 – 1,435]	0.007
Contraceptive use			
Modern method user	Reference		
Traditional method user	1,399	[0,975 – 2,009]	0,068
Non-user - intends to use later	1,244	[1,009 – 1,535]	0,041
Does not intend to use	1,469	[1,199 – 1,801]	0,000
Antenatal attendance			
Traditional birth assistance	Reference		
Health center assistance	1,127	[0,914 – 1,389]	0.261
Region of the mother			
1=Centre	Reference		
2=Adamawa	0,986	[0,708 – 1,373]	0.938
3=East	0,618	[0,451 – 0,848]	0.003
4=Far-north	1,477	[1,123 – 1,941]	0.005
5=Littoral	1,292	[0,971 – 1,719]	0.078
6=North	1,597	[1,207 – 2,113]	0.001
7=North-west	0,679	[0,457 – 1,010]	0.056
8=West	0,960	[0,725 – 1,270]	0.776
9=South	0,981	[0,737 – 1,306]	0.897
10=South-west	1,358	[0,724 – 2,545]	0.339
Area of residence of the mother			
Urban	Reference		
Rural	1,090	[0,904 – 1,315]	0.365
Constant	0,0088	[0,004 – 0,017]	0.000
Nomber of observations	9085		
LR chi2 (Prob>chi2)	1408,89 (0.000)		
Pseudo R^2	19,30		

Source: Authors' calculations based on EDS 2018 data, *** p<0.01, ** p<0.05, * p<0.1

4. Discussion

In this study, we examined the economic and social determinants of children and their mothers aged between 15 and 49 years in relation to under-five mortality in Cameroon. In the study sample, we found a survival rate of 82.69% versus a mortality rate of 17.31% among children under five in Cameroon. This high prevalence of infant mortality in the present study is similar to those of some previous studies in developing countries [8, 15, 24]. We found a significant association ($p<0.05$) between child age and infant mortality. We note that this prevalence varies slightly with the age of the child, rising from 2.58% for children aged under 12 months to 2.99% for children aged 37 to 48 months. These results corroborate those found by other authors in the Democratic Republic of Congo and Cameroon [22, 25]. In relation to the child's sex, girls are more likely to die than boys, but the difference is not statistically significant. This may be explained by the possible family preferences of boys over girls, so that in some households male children receive more care and attention than girls, and these sociocultural and ethnological considerations of negative discrimination may negatively influence the survival of some children, particularly female ones. Similar results have been found elsewhere in previous studies of infant mortality [6, 9]. The results of this study also illustrate that birth order is an important determinant of infant mortality, as children born in the fifth birth order and above are 58.5 times more likely to die before their fifth birthday, and children born in the fourth birth order are 24.5 times more likely to die, than children born in the first birth order (primiparous), so the susceptibility to die as birth order increases, with a statistically significant difference in deaths between the different birth orders ($p<0.00$). Thus, infant mortality increases with the child's birth rank, because in a context of limited resources and rampant poverty, the higher the number of births, the more households face problems of care and management from pregnancy through childbirth and birth to age five and beyond. These results corroborate those of a previous study on the determinants of mortality in Arab countries [24].

In relation to birth weights, and compared with children

born at high birth weights, and as expected, children with low birth weights were more likely to die, and the susceptibility to die before the fifth birthday varied relatively with birth weight, but with a statistically insignificant difference overall ($p>0.05$). These results are in line with those of previous studies [26]. With regard to the number of children in the household and compared with households with one child, children from households with several children were relatively more likely to die than those from households with fewer children, but with a significant up to three children and non-significant above three children. This may be explained by the fact that in households with several children, the means to provide sufficient care and basic needs for all are limited, in a context where the level of poverty is relatively high in society. These results are in line with those of previous studies on economic and social factors affecting high infant and child mortality rates in selected African countries: does globalisation play any role? [26]. On the other hand, in the case of domestic violence, the children of mothers who have suffered violence are more likely to die than those of mothers who have not suffered violence, with a statistically significant difference ($P<0.01$). This is because in households experiencing domestic violence against mothers, children are more often than not neglected and left to fend for themselves without adequate nutritional and health monitoring, and above all because domestic violence has a negative impact on parents' conduct in relation to good child care and nutrition. The results of this study corroborate those of a previous study on infant mortality trends and determinants in Kazakhstan [1]. Similarly, there was a non-significant association between the mother's marital status and infant mortality. We found that children of single mothers were less likely (OR=0.96; $p>0.05$) to die than children of married or cohabiting mothers. This would be due to the possibility of financial support from their husbands. These results corroborate those found by other authors who have studied infant mortality in other countries around the world [9, 10]. We also found a highly significant association between infant mortality and maternal age. Thus, children of mothers in the 25-34 (OR= 0.60; $p<0.00$) and 35-49 (OR= 0.64; $p<0.00$) age groups were very significantly less likely to die than children of mothers in the "15-24" age group. This could be explained by the fact that women under 25 are still inexperienced in maternity compared to women over 25. These results are similar to those of previous studies analyzing maternal age and infant mortality [6].

Although there was no statistically significant association between the mother's level of education and infant mortality in this study, we did note that the children of mothers with primary and secondary education were less likely to die than those of mothers with no education, while the children of mothers with higher education were 1.3 times more likely to die than those of mothers with no education. This may be explained by the fact that mothers with higher levels of education are more often occupied with following their more time-consuming professional careers, and more often entrust their children to group or individual childcare in urban and semi-urban areas of Cameroon. While the results for mothers with primary and secondary education corroborate those of previous studies, the results for well-educated mothers with tertiary education contrast with those of other studies on infant mortality in many developing countries [24, 27, 28].

Similarly, although there was no statistically significant association between the level of wealth of the child's household and infant mortality in this study, we did note that children of mothers with average, rich and very rich levels of wealth were less likely to die than children of mothers with poor and very poor levels. These results corroborate those of a previous study [11] which showed that, in the case of Ethiopia, children born to poor women were more likely to die than those born to rich women. Similar results were also found by previous studies in Pakistan and in the study on joint distribution of child mortality and wealth across 30 sub-Saharan African countries over 2000-2019 [6, 9, 29]. Although there was no statistically significant association between maternal employment status and infant mortality in this study, we did note that children of working mothers were more likely to die than children of unemployed mothers. This could be explained by the fact that these children are often abandoned to their elders, and baby-sitters are often poorly paid. These results corroborate those found in other similar studies in developing countries [6, 9].

Infant mortality is not sufficiently linked to any religion, even though the children of Christian mothers of all faiths were relatively more likely to die than the children of mothers who practised the Muslim, animist, no religion and other religions, but with a non-significant difference between the different religions. Similarly, while there was no statistically significant association between the mother's place of residence and infant mortality in this study, we did observe that children of mothers in rural areas were more likely to die than children of mothers in urban areas. These results corroborate those found in a previous study in Guinea [8]. We also found a highly significant association ($p<0.01$) between infant mortality and the number of children in the household. Thus, in households with more than 2 children, children were very significantly more likely to die than single child in the household. This could be explained by the fact that women with only one live birth can spend more times for caring for their children compared to women with more than two children to caring for them. These results corroborate those of previous studies about the size of children in the households and infant mortality [8, 29].

Mothers' access to media influences their children's susceptibility to death. Children of mothers with access to media were slightly more likely (OR=1.01) to die than children of mothers without access, but this was not significant. However, it was expected that access to the media would raise mothers' awareness of good child protection through education and communication on good breastfeeding and child nutrition practices. This can be explained by the fact that mothers with greater access to the media are those with a higher level of education, and infant mortality was found to be higher among these better-educated mothers. These results contrast with those

of previous studies on the determinants of infant mortality [6, 9, 26]. Similarly, mothers' use of contraception appears to influence infant mortality, as children of mothers who used traditional contraceptive methods, children of mothers who used no contraceptive method but intended to use it, and children of mothers who had no intention of using it, were more likely to die than children of mothers using modern contraception. These results may be explained by the fact that mothers using modern contraception are able to space births between children, which offers the opportunity to take good care of the child before the onset of the new pregnancy and the mother's newborn. These results are consistent with those obtained by other similar studies in developing countries on the determinants of neonatal, infant and under-five mortalities [30].

The results of this study show that the choice of providers for prenatal consultations does not influence infant mortality. Thus, the children of mothers who made their prenatal visits at the health center were only 1.13 times non-significantly more likely ($p<0.26$) to die than the children of mothers who made their prenatal visits at the traditional birth attendant. However, it was expected that children of mothers who attend antenatal clinics in formal health facilities would be less likely to die, as they would benefit from more appropriate advice on child survival. These results do not corroborate those of other previous studies [31, 32]. With regard to regions of residence, infant mortality varies from one region to another, although there are similarities: compared with the Centre region, children in the Adamaoua, Littoral, North-West, West and South regions were significantly less likely to die, while children in the South-West Far-North, East and North regions were significantly more likely to die than those in the Centre region. This may be explained by the variation in economic and social, demographic, epidemiological and environmental conditions across and between regions. These results are consistent with those of a previous study on infant mortality trends and determinants in Kazakhstan [1].

5. Study Limitations

Although this study has provided important information on the economic and social determinants of infant mortality in Cameroon, the use of cross-sectional design limits the likelihood for making any judgements on the changes in these determinants of mortality over time. In addition, other determinants such as environmental factors, several population health and health service-related factors that can influence infant mortality rates were no included in this study. Based on these limitations the results of this study can be somewhat interpreted with some cautious before any generalisation.

6. Conclusion

The infant mortality rate is an important public health indicator and a reflection of a country's economic and social development, as it is closely linked to maternal health and is a key determinant of a nation's health. However, there are significant challenges to be overcome to further reduce IMR in the Sub-Saharan African region. This study has identified various economic and social determinants of infant mortality that require particular attention to improve the child health performance of the health system in a resource-constrained country like Cameroon. Improving economic and social conditions, reducing poverty and income inequality, improving access to education, reducing household fertility rates and reducing domestic violence are all potential avenues for improvement. In addition, the study identified child age, birth order, modern contraceptive methods, absence of domestic violence, number of children in the household and mother's age as significant factors associated with under-five mortality in Cameroon. Thus, the planning and implementation of relevant strategies that focus on the identified economic and social determinants of under-five mortality are necessary to improve child survival in resource-limited countries in Sub-Saharan Africa and elsewhere around the world.

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